

THE BEES OF THE GROUP DIEUNOMIA

BY BEULAH HIX BLAIR

Introductory Note

The group called *Dieunomia* has been treated as a genus, but it is probably best regarded as a subgenus of *Nomia*. The genus *Nomia* (see American Museum Novitates, No. 433) is very richly represented in Africa, tropical Asia and Australia, and is doubtless of Old World origin. It is evident, however, that the relatively meagre *Nomia*-fauna of America includes at least three different groups, the ancestors of which must have come over from Asia at different times. Probably the oldest of these is *Dieunomia*, which is widely distributed, but not represented in the Pacific Coast region. The case is analogous to that of the pipits among the birds. The genus *Anthus* is a typically Old World type, which has become widely distributed in North America. Our common western bird is considered a subspecies of the *Anthus spinoletta* of Europe. But in the interior plains, evidently representing a much earlier migration, is *Anthus spraguei* Audubon, so distinct as to be placed in a separate subgenus *Neocorys*.

The *Dieunomia* group has two subgroups, represented by *D. bolliana*, a relatively small species found in Texas, and lately by Timberlake in New Mexico; and by *D. apache* of Colorado, New Mexico and Texas, of which *D. mesilla* is presumably the male. Mrs. Blair's paper is primarily concerned with the very interesting case of *N. heteropoda* Say, with its races and varieties. This is a species of sandy regions, which is shown by Mrs. Blair to have two races or subspecies. The northern one, very likely Post-Pleistocene in origin, is found from Minnesota to Illinois, and east to Maryland. The actual distribution is not known in detail, but it is probably discontinuous, depending on suitable environments. The southern, more robust, race occurs in Texas and adjacent states. It is very interesting to find that both races vary independently in the color of the wings and pubescence, so that each presents four varieties, very distinct in appearance, exactly parallel and undoubtedly due to the combinations of Mendelian factors. There are in addition two forms of the southern race, *atripennis* and *semirubra* (Novitates 697, p. 6) which appear to be more than Mendelian varieties, and are perhaps to be regarded as subspecies. They presumably have no representatives in the north.

Thus we have a case which should be of interest to biologists generally, illustrating as it does the phenomena of evolution and variation.

T. D. A. COCKERELL

The collection of bees sent from the University of Minnesota by Dr. Clarence Mickel contained some specimens of *Nomia heteropoda* which were somewhat smaller, with a narrower abdomen and a neater appearance, not so robust as those collected in Kansas and other more southerly states. Immediately upon seeing these specimens, Dr. T. D. A. Cockerell remarked that they must indeed be the same as the original *N. heteropoda* that Thomas Say described after his trip to this region.

The description is given in "Major Long's Expedition to the Source of St. Peter's River, Lake Winnepeck, Lake of the Woods, etc.," published in 1824. St. Peter's River is now known as the Minnesota River, and these *N. heteropoda* Say were collected on July 19, 1923, on the Barden Sand Dunes, between Savage and Shakopee, about twenty miles from the mouth of the Minnesota River. Say passed through here in 1823 on July 10.

The latitude of the mouth of the river is $44^{\circ} 53' 49''$ N., which they passed on the afternoon of July 9. On the evening of July 12 the party camped at Lat. $44^{\circ} 33' 59''$ N. Sand hills are mentioned as being seen along the river. Say's party followed the left bank on land until July 11 when he crossed the river to the right bank. Long's party went up the river. During July 10, therefore, Say passed through the Barden Sand Dunes. These Dunes have a latitude of about $44^{\circ} 45'$ N.

Dr. Clarence E. Mickel, of the University of Minnesota, said that when he and Dr. E. W. Dawson collected these large black bees, they noticed them going in and out of burrows in the sand. They dug into these, hoping to find some cocoons or some evidence of mutillids but found none. They found, however, that the burrows of the bees extended down into the sand vertically for a distance of three or four feet.

Until the present, because no *N. heteropoda* Say were listed from the Northern states, as far as I know, it was supposed that they were only found in the southern sandy regions. For this reason it was believed that Say found his species on his western

trip in 1818-20 though it was not described until 1824, after his return from his northern trip. The description, however, is published with the report of the northern trip.

Now that we have specimens from this territory through which he passed it is quite obvious that the original *N. heteropoda* Say came from somewhere in the north country. To say exactly where the type locality is would likely be impossible, because I also have some *N. heteropoda* Say from Meredosia on the Illinois River (Grace Wiley). However, this locality is one hundred and fifty miles south of Say's path.

In my collection, I also have a *N. heteropoda* Say from Budd's Ferry, Maryland, collected in August, 1914, by R. C. Shannon. This is the same as those found in Minnesota and Illinois. Say, in his description, gives three habitats: Northwest Territory; Arkansas; and Maryland. Since we have specimens, which are the same, from two of the habitats, and which fit the original description exactly, it seems that we have conclusive evidence that typical *N. heteropoda* Say is not the larger subspecies of the southwest.

The original description exactly fits that of the northern subspecies, but not quite that of the southern subspecies. It is, therefore, necessary to apply the original name *N. heteropoda* Say to the northern subspecies, and to treat the southern form as a subspecies.

The *N. heteropoda* group is one species with subspecies and varieties. These divisions are based principally upon the color of the pubescence and the wings.

Probably the difference in the amount of dark pigment is due to various factor combinations in the genes, thus giving a variety of color among the bees of the same species. Of those bees I have examined, black outnumbers the ashen colored about four times. This is also true of the wings, the entire dark wings being the more common. The number I have examined, however, is limited to about forty specimens.

Until the present only one series was known, that found in the more southerly states. We must now recognize a northern series.

Description:

The *Nomia heteropoda* Say group belongs to the sub-genus,

Dieunomia Cockerell, 1899. (*Eunomia* Cresson 1875 preoccupied). The species are large, with black bodies and no iridescent bands. The apical joint of the male antenna is flattened and broadened; flagellum crenulated above. (American Bees of the Genus *Nomia*, Cockerell, 1910).

General description of *N. heteropoda* Say group:

Male. Hind legs.—Black; femora greatly swollen; tibiæ much enlarged and greatly modified, being triangular in shape and compressed; excavated on inner side. They bear two spurs. The basitarsi are very much elongated and are about five-sevenths of the length of femur plus the tibia. They bear a fringe of hair on the inner side.

Middle legs.—Black; femora greatly swollen, more so than hind legs. The simple tibiæ bear no spurs.

Abdomen.—Densely punctured; anterior part of the first sternite is greatly indented on median line. Dorsal side of the first sternite has a shallow concavity.

The fourth tergite has a narrow median suture parallel sided at the posterior edge but spreads into a broad triangle at anterior edge; posterior corners are slightly extended.

The fifth tergite has two small tubercles, one on each side of the median line.

Thorax.—Punctures on scutellum coarse and irregular; on mesothorax, large and more regular. Pubescence very dense on dorsal side.

Wings.—Venation is slightly different from the *Paranomia* group. The third cubital cell is somewhat smaller in comparison, whereas, the second cubital is larger. The basal nervure is nearly straight. More detail is given under Morphology.

Tongue.—Median length, broad at base, narrows to apex. Paraglossa comparatively long. See Morphology for details.

The female has the legs and antennæ of the ordinary *Andrenid* type.

The Northern Series:

This series of the *N. heteropoda* Say group is smaller than those of the southern series. The males are about 17 mm. in length; width of abdomen 5 mm.; anterior wing 14 mm. long. Females.—Length 14 mm.; width of abdomen 4 or 5 mm. There

are no hairs in region of ocelli. The head and thorax are highly polished. The abdomen is brownish black.

N. heteropoda (Say)

The northern species bears this name. A male was described in 1824 in "Major Long's Expedition to the Source of St. Peter's River, etc." The description fits exactly the species I have before me from Barden San Dunes, Minnesota; Meredosia, Illinois, and Budd's Ferry, Maryland.

Male: Wings.—Yellowish hyaline with dark apical border.

Body.—Abdomen brownish black with reddish brown hair bands.

Thorax.—Shiny black.

Pubescence.—Ashen colored on thorax and face. Hair fringe of hind basitarsi red.

Localities: Males; Barden Sand Dunes, Scott Co., Minnesota. July 19, 1923 (R. W. Dawson).

Meredosia, Morgan Co., Illinois. August 19, 1913.—Sand Pit (Grace Wiley).

Budd's Ferry, Maryland, August, 1914. (R. C. Shannon).

This is parallel to the southern species *N. marginipennis* Cresson.

N. heteropoda valida (Say)

Dr. Cockerell explains in a recent publication, American Museum Novitates No. 697, March 6, 1934, how *Andrena valida* of Say was really a species of *Nomia*. Dr. Cockerell, however, applied the name to a southern *Nomia heteropoda* variety, because he was not aware of the northern species since no record of them had been published as far as we know. Now that we have species from this region, the name naturally applies to the species of the northern series which is parallel to this one of the southern series.

Male: Wings.—Fuliginous throughout; tegulae very dark.

Body.—Abdomen, brownish black with black hair.

Pubescence.—Coal black on dorsal part of thorax, on side of thorax and face, brownish black.

Hair fringe of hind basitarsi red.

Female: Length of body 14 mm.; width of abdomen 4 mm.

Pubescence.—Coal black on thorax, face and ventral side of abdomen.

Otherwise same as male. Legs normal. Antennæ normal.

Locality: Barden Sand Dunes, Scott Co., Minnesota. July 19, 1923 (R. W. Dawson).

15 males. 2 females.

This form is parallel to *N. validor* of the southern series.

N. heteropoda validescens new variety

General description and measurements given above.

Male: Wings.—Fuliginous throughout, tegulæ very dark.

Body.—Abdomen brownish black with very dark brown hair.

Pubescence.—Ashen colored on thorax and face. Fringe of hair on hind basitarsi red.

Type locality: Barden Sand Dunes, Scott Co., Minnesota. July 19, 1923 (R. W. Dawson).

Type specimen: University of Minnesota. Date as shown above. This variety is parallel to *N. semivalida* Ckll. of the southern series.

N. heteropoda subvalida new variety

General description given above.

Female: Wings.—Yellowish hyaline with dark apical border; tegulæ nearly black; length of anterior wing 14 mm.

Body.—Length about 15 mm.; brownish black with black hair.

Pubescence: Coal black, on thorax and face. Fringe of basitarsi brownish black.

Type locality: Budd's Ferry, Maryland, August, 1914 (R. C. Shannon). From U. S. National Museum.

This species answers to the description of the female *N. marginipennis* Cresson with the exception of size. ("Report upon the Collections of Hymenoptera made in portions of Nevada, Utah, Colorado, New Mexico and Arizona—1872, 1873, 1874." E. T. Cresson. Chap. VII.) The description gives the bordered hyaline wing in combination with black pubescence. The male described, which is designated as the type of *N. marginipennis* Cresson, has the combination of the bordered hyaline wing in combination with ochreous pubescence.

N. marginipennis Cresson based on the male, is the southern

subspecies of *N. heteropoda* Say. *N. heteropoda subvalida* is a variety of *N. heteropoda* Say. The female described as *N. marginipennis* is really a variety of the subspecies *N. marginipennis* Cresson.

The above described form therefore belongs to the northern series, which is parallel to the female described by Cresson, *N. heteropoda subvalidior*.

The Southern Series:

The southern series are about 20 mm. long; abdomen about 6 mm. wide; anterior wings about 17 mm. long. The metathorax is slightly more hairy, giving it a duller appearance than the northern species. Abdomen is black or brownish black. Females about 18 mm. long; 5 to 6 mm. wide.

N. heteropoda marginipennis (Cresson)

Because this species is very much like *N. heteropoda* Say and because it was thought that *N. heteropoda* Say referred to a southern species, as does *N. marginipennis*, Dr. Cockerell believed them to be the same species and since *N. heteropoda* was first described it was designated as the type. Now that *N. heteropoda* Say has at last been found, *N. heteropoda marginipennis* Cresson is again correctly applied to a subspecies which must be considered valid. The male, *N. marginipennis* Cresson was designated by Cresson as the type, the locality being given as "Colorado."

Wings.—Yellowish hyaline with dark apical border.

Body.—Black; head and thorax duller in appearance than northern variety, due to small hairs.

Pubescence.—Ashen colored on face, thorax and front legs.

Hair fringe of hind basitarsi red. Localities: Bexar Co., Texas—July 13 and June 24.

(Mr. H. B. Parks); Wellington, Kansas (E. G. Kelly); Rocky Ford, Colorado (Prof. C. P. Gillette.)

This form is parallel to typical *N. heteropoda* Say of the northern series.

N. heteropoda kirbii (Smith)*

General description and measurements given above.

* Since this was written, I have found that the name *N. kirbii* Smith, 1865, is applicable to the present variety as will be explained in a later paper.

Male: Wings.—Fuliginous throughout, tegulae very dark.

Length 3 mm. longer than *N. heteropoda valida* Say.

Body.—Black with black hair. Head and thorax somewhat duller than northern series.

Pubescence.—Coal black on dorsal part of thorax; on side of thorax and face chocolate colored. Hair fringe on basitarsi red.

Female: Length of body 18 mm. Wings nearly 16 mm.

Pubescence: Black on thorax, face and ventral side of abdomen. Legs and antennæ normal, otherwise, as male.

Type locality: Bexar Co., Texas, June 24, July 13 (Mr. H. B. Parks).

This variety is parallel to *N. heteropoda valida* Say of the northern subspecies.

N. heteropoda subvalidior new variety

This variety was described by Cresson as the female of *N. heteropoda marginipennis*, but the male is designated as the type. It is another variety. General description given above.

Female: Wings.—Yellowish hyaline with dark apical border.

Pubescence.—Black on thorax and face. Hair on legs brownish black.

Locality: Cresson recorded his *N. marginipennis* from "Colorado, New Mexico." This species is parallel to *N. subvalida*.

The remaining forms of the southern series are discussed in the American Museum Novitates No. 697, March 6, 1934, described by Dr. Cockerell.

KEY TO DIEUNOMIA

(Based on males unless otherwise specified.)

1. Hind tibiae with a large oblique flattened quadrangular process, either all reddish yellow or black with honey colored lobe. (Similar to *Paranomina*.) (Female.—Length about 13 mm. or less. Not so deep a basin in 1st tergite)2
- Tibiae of hind legs short, triangular flattened undulate beneath, the apex beneath, dilated and truncate or subbilobate, their tarsi slender and fringed with long hair on inner side, nearly as long as femora and tibiae together (Fig. 7) *N. heteropoda* Say, races and varieties. (Female.—Length 14 mm. or more. Deep basin in 1st tergite).....3
2. Length about 15 mm. Anterior wing 13 mm. Gray pubescence. Legs.—Black; hind, with honey colored lobe on tibiae and honey colored tarsi. Hind femora enormously swollen and covered with long gray hair. (Apparently the male of *N. apacha*.) *N. mesillae* Ckll.

Female.—First tergite polished, with widely separated punctures. Abdomen gray above; rusty red hair on sternites and legs. Legs normal. *N. apacha* Cresson.)

Length about 13 mm.; Anterior wings 11 mm.; Sandy red pubescence.

Legs.—Orange fulvous; hind femora black, swollen and covered with sandy red hair. Tibiæ and tarsi orange fulvous.

Female.—Generally orange red hair including legs. Rusty red hair on sternites. Length about 11 mm. (Texas; and also a male taken by Mr. Timberlake at Albuquerque, New Mexico.) *N. bolliana* Ckll.

3. Robust; anterior wing 17 mm.; body about 20 mm.; abdomen brownish black or black. Female.—about 17 mm. long. Kansas, Colorado and Southwest4

Not so robust; anterior wing 14 mm.; body about 17 mm.; abdomen brownish black.

Female.—About 14 mm. long. Minnesota, Illinois, Maryland12

4. Hind margins of segments with distinct pale hair bands, gray, ashen or reddish yellow. Tegulæ light fulvous; pubescence of thorax gray to reddish yellow.

Female.—Sandy red to gray hair on sternites. *N. variety xerophila* Ckll.

Hind margins of segments testaceous; no distinct hair bands; segments covered with brownish black hair; tegulae piceous5

5. Wings fuliginous throughout6

Wings yellowish hyaline with dark apical border8

6. Pubescence on thorax and face ashen color. *N. variety semivalida* Ckll. Pubescence not ashen color7

7. Pubescence black on thorax and chocolate color on face. Female.—Black face. *N. variety kirbii* (Smith).

Pubescence on dorsum of thorax red, on underside of abdomen black. *N. variety atripennis* Ckll.

8. Pubescence ashen color on thorax and face. *N. heteropoda marginipennis* Cresson.

Pubescence not ashen color9

9. Pubescence rusty red brown. Hair on underside of abdomen black. *N. variety semirubra* Ckll.

Pubescence black. (Described by Cresson as female of *N. marginipennis*). *N. variety subvalidior* n. v.

10. Wings yellow hyaline with dark apical border11

Wings fuliginous throughout12

11. Pubescence ashen color. *N. heteropoda* Say.

Pubescence black on abdomen, thorax and face; brownish black on legs. (Female) New variety *subvalida* n. v.

12. Pubescence coal black on thorax; chocolate colored hair on face of male. Female.—Black face. New variety *valida* Say.

Pubescence ashen color on thorax and face. New variety *validescens* n. v.

Morphology of *N. heteropoda valida* Say

The male genital armatures of *Nomia* have very good characters for determining groups or sub-genera within the genus. (Fig. 1.)

Genitalia:

The cardo (anterior end) is rounded. The ventral side is about three times as long as the dorsal side. On the ventral side along the median line is a large elliptical hole, which reaches almost from the anterior edge to the posterior edge of the genitalia.

The stipites have large basal lobes next to the cardo, these almost meet on the median line. These lobes extend posteriorly on each side beyond the sagittae, forming the posterior end of the genitalia. These extensions or flanges have smaller flanges parallel to them on the dorsal side.

The sagittae, the two independent structures along the median line, are partly covered by the lobes of the stipites and the cardo. They flare broadly at the posterior end, but are pointed at the anterior end. Near the center of the sagittae are several wings extending from them. Across from these wings and slightly posterior are small wings on the stipites. The posterior tips of the sagittae bend over toward the ventral side, as do the ends of the stipites.

Sternites:

The eighth sternal plate fits tightly over the ventral surface of the genitalia. The point fits down between the sagittae pointing posteriorly (Fig. 2).

The seventh sternal plate, with its few but long slender hairs, fits over the eighth plate. (Fig. 3.)

The sixth plate fits over the seventh under which is the eighth and entirely covers them. A small portion of this plate is exposed. The posterior edge bears plumose hairs. (Fig. 4.)

The fifth sternite is interesting because of the two tubercles. Upon these are chitinous hairs while the outer edges of the tubercles are very thickly covered with short chitinous structures that are very dark. Long plumose hairs extend from the posterior edge of the plate. They are especially thick on the points. (Fig. 5.)

Mouth parts:

The *Nomias* have no special division of the class. They have a well developed inner comb bearing about twenty-four teeth. This comb is mesad of the palpus on the basal part of the galea. The lacina, a small finger-like structure is beset with bristles. (Fig. 12.)

The labial palpi are four jointed broad but compressed. The *N. heteropoda* have much stouter joints than do those of *Paranomina* and *Dieunomia*. The first joint is nearly three times the length of the second. The paraglossa seem to be longer and stouter than those of *Paranomina* and *Dieunomia*. The mentum is completely dark colored. This is not true of the other groups which have a lighter color across the mentum where the glossa and palpi join. (Fig. 11.) The maxillary palpi are six jointed, the second joint being larger which is true of the other *Nomia*.

Legs:

The legs are elaborate and bear plumose hairs. The femora of the middle and posterior pairs are greatly swollen. The hind basitarsi are about five-sevenths of the length of the femur and tibia combined. (Fig. 7.) The lack of spurs on the middle tibiae is typical of this group. (Fig. 8.) The spurs on the hind tibiae are serrated. The hairs of the tarsi are quite interesting. There is one main branch which has hairs growing from it that are arranged alternately. (Fig. 9.)

The two claws are bidentate and bear hairs. A pad is present which also bears hairs some of which are quite long.

Wings:

The venation of *Dieunomia* is slightly different from those of *Paranomina*. The third sub-marginal is not so long, and the second sub-marginal is larger in comparison with the other cells. *Dieunomia* differs from the *Epinomia* by the larger second sub-marginal cell.

The whole venation of the *Dieunomia* is somewhat straighter and not quite so graceful as the other groups. The color of the wings is darker. (Fig. 6.)

Miss Helen Gibbons, who is working on the corrugations or folds along certain lines in the wings, called my attention to the folds of the *N. heteropoda* Say group. I therefore included these

in my drawing of the wing. (Fig. 6.) She described these thus: "The upper branch of the median furrow is not so definite or well marked as the lower. In the *N. heteropoda valida* Say specimen it appears considerably longer than in the *N. heteropoda validior*. In the lower branch of the median furrow, extending from the base of the stigma is seen a spine-like projection which I interpret to be the remnant of a vein which at one time divided the first cubital in two—the first cubital is thus considered to be the coalesced first cubital and first marginal cells, the large marginal cell representing, morphologically speaking, the second and perhaps the second and third marginals. This remnant is very faint in these two *Nomia* specimens. The upper branch of the median furrow is not marked by the presence of bullae in the veins it crosses. The bullae of the lower part of the transverso-cubitae, first and second recurrent, lowest part of discoid nervure and nervulus are strongly developed. In the *N. heteropoda valida* Say bulla are seen in the lower part of the third transverso-cubital nervure. In the *N. heteropoda validior* no bulla are seen here. The upper branch of the median furrow cuts through the first and second transverso-cubital nervures in *N. heteropoda valida* Say whereas in *N. heteropoda validior* the upper branch cuts through only the first transverso-cubital nervure." However only a few specimens were examined.

POSTSCRIPT

In the collection sent from Cornell University, by Dr. J. C. Bradley, I found the following:

N. heteropoda (Say).

1 male; Georgia, Bainbridge. Sept. 3-7, 1910. (J. C. Bradley.)

7 females; Georgia, Butler's Ferry. Aug. 12, 1931. (Bradley and Knorr).

N. heteropoda validescens Blair.

3 males; 1 female; Alabama, Mobile. Aug. 10. (Löding.)

11 males; 1 female; Georgia, Butler's Ferry. Aug. 12, 1931. (Bradley and Knorr.)

N. heteropoda valida (Say).

6 females; Georgia, Butler's Ferry. Aug. 12, 1931. (Bradley and Knorr.)

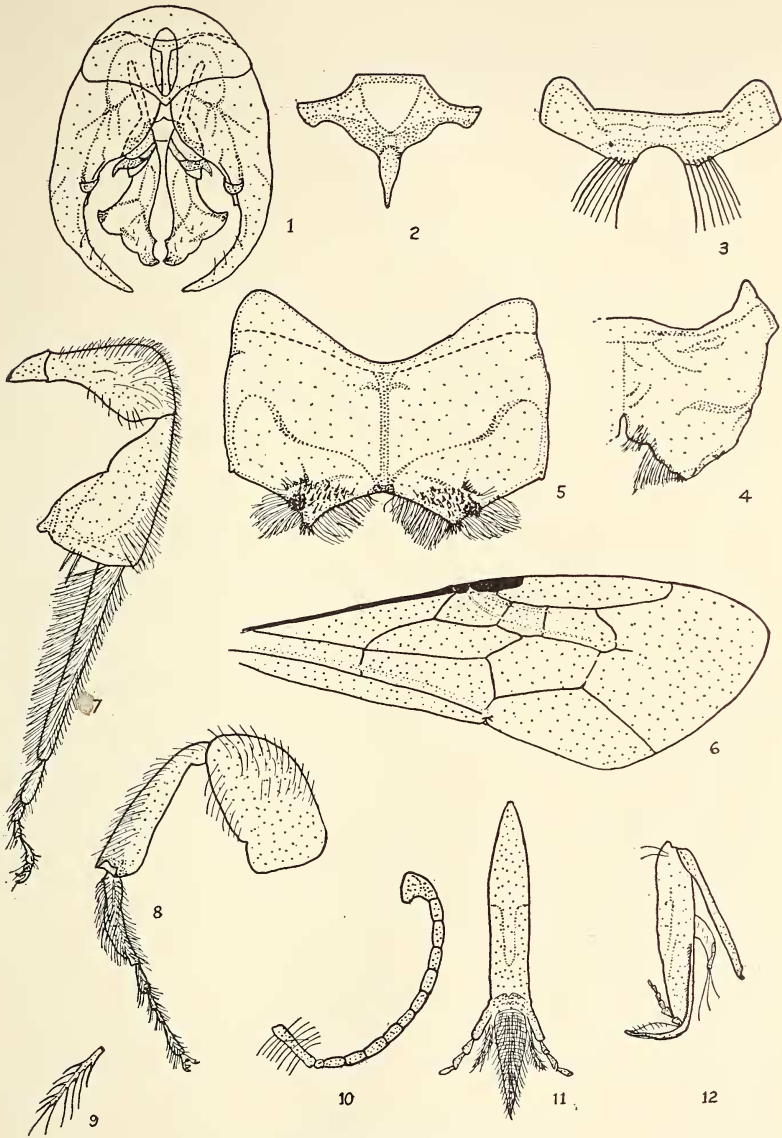
1 female; Florida, Marianna. Aug. 12-13, 1931. (Bradley and Knorr.)

[The extension of the range of the supposed northern form, as shown by the above records, was quite unexpected. The relative ranges of *N. heteropoda* and *N. marginipennis* are now seen to be similar to (though not strictly identical with) those of *Dasy-muttilla occidentalis* (L.) and *D. occidentalis comanche* (Blake). The range of the typical subspecies of *N. heteropoda* is similar to that of the Sugar Maple (*Acer saccharum*) or the Red Ash (*Fraxinus pennsylvanica*).—T. D. A. C.]

PLATE XVI

N. heterapoda valida Say. Male. Fig. 1. Ventral view of genitalia. Figs. 2-5. Ventral view of tergites; 2, Eighth; 3, Seventh; 4, Sixth; 5, Fifth; Fig. 6, Anterior wing; Fig. 7, Hind leg; Fig. 8, Middle leg; Fig. 9, Basitarsus hair enlarged; Fig. 10, antenna; Fig. 11, Glossa and Mentum; Fig. 12, Maxillary blade.

Note. 1-5. Posterior ends down. Figs. 1-5, 11, 12, drawn to same scale. Camera lucida was used.



DIEUNOMIA